Raven Aerostar

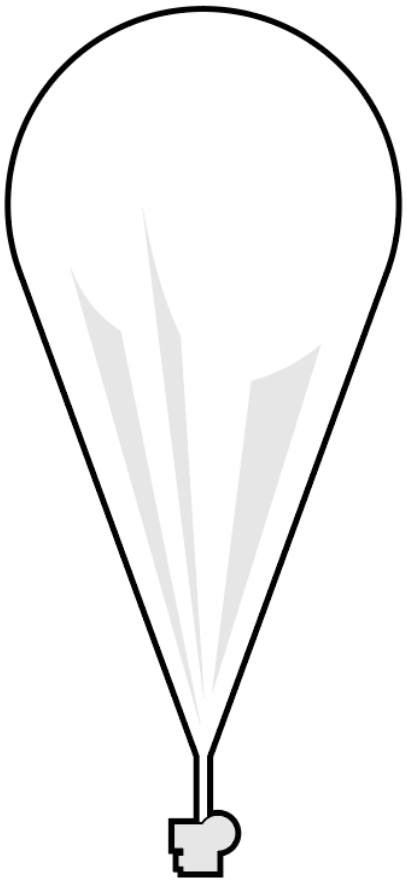
CYCLONE ZERO-PRESSURE BALLOON

NASA TECHRISE STUDENT CHALLENGE

Vehicle Summary

Raven Aerostar's Cyclone zero-pressure balloon system is a rapidly-deployable balloon system capable of achieving altitudes from 50,000 ft – 130,000 ft with a wide variety of user payloads. For NASA TechRise, the balloon will launch and ascend to the NASA TechRise float altitude of approximately 70,000 feet. Once the flight vehicle reaches float altitude, the system takes advantage of stratospheric wind patterns to steer the balloon. Using altitude control maneuvers like venting lift gas (causing the balloon system to descend) or dropping ballast (causing the balloon system to ascend), the Raven flight engineer can find the best wind layer to steer the platform in the desired direction. Once the mission is complete, the Cyclone flight is terminated, and the payloads are cut away from the balloon and descend on a parachute for recovery by Raven flight crews. Raven Aerostar's Cyclone zero-pressure balloon system will enable NASA TechRise students to conduct remote sensing and climate/atmospheric experiments.

Flight Integration Details



Raven Aerostar Cyclone Zero Pressure Balloon

Requirements	RAVEN AEROSTAR + NASA TECHRISE
Maximum Size	4 in x 4 in x 8 in (10.16cm x 10.16cm x 20.32 cm)
Total Maximum Weight	2.2 pounds (1 kilogram)
Provided Flight Box Weight	Approximately 0.4 pounds (180 grams)
Liquids	150ml non-hazardous liquid; Double containment required
Biologics	Experiments that grow or monitor living organisms are not allowed; Seeds or plant substrates (e.g.: soils, artificial soils) are allowed
Extra Batteries	No. Please rely on the vehicle power outlined below
Wireless Communications	No Bluetooth, Wifi, or other RF communications
Lasers	Lasers not allowed for TechRise Balloon Experiments ** CLARIFICATION: Sensors that use internal lasers to detect particles or other atmospheric data (i.e. PM/air quality sensors) are allowed so long as students are not directly interacting with the laser.
Power & Data	
Connector	DB - 9
Voltage	9 V
Current	1.5 A
Vehicle Data	Yes, vehicle telemetry is streamed to each experiment as serial data
Key Event Triggers	No. Experiments must rely on the vehicle data stream or their own sensors for event triggers, if needed
Environmental Conditions	
Overview	Experiment is attached to a gondola frame and exposed to ambient atmospheric temperature/pressure
Flight Location	South Dakota (estimated travel E/SE 200-300 miles)
Launch Conditions	Morning Launch; Less than 30% cloud cover; No rain
Float Altitude	Approximately 70,000 feet for 4 hours
Temperature	5C to -82C (However, since the payload will be insulated with some foam, we recommend components rated to -40 degrees C)
Line of Sight	Experiment will have line of sight in two directions during flight - Down to Earth (Nadir) and out to the horizon (Horizontal)
Pressure	4,412 Pa to 96,526 Pa (0.64 psi psi to 14 psi)
Acceleration	Up to 6g in any direction
EMI / Vibration / Shock	Upon request: support@futureengineers.org

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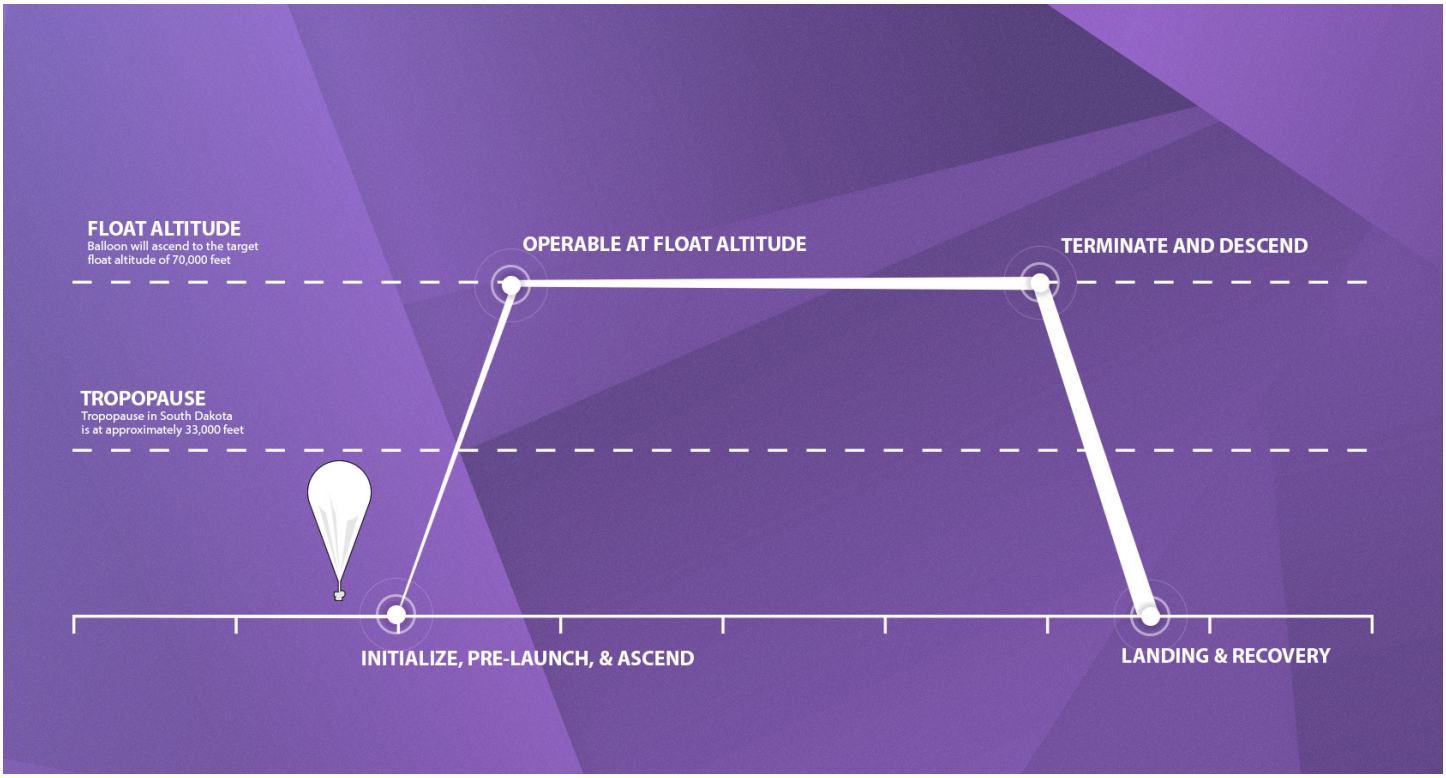
FLIGHT PROFILE & SIMULATOR



FLIGHT BOX

Winning teams assigned to high-altitude balloon flights will receive a 3D-printed Flight Box and a Technical Development Setup Guide.

FLIGHT PROFILE DETAIL

Initialize **Pre-Launch** **Ascend**	Flight experiments will be powered on and readied for flight. Target launch time is 7AM. Experiments will ascend through the troposphere into the stratosphere. During ascent, experiments will be operational and can collect data.
Operable at Float Altitude	After about 1 hour of ascent, the experiments will float at the target altitude of 70,000 feet for at least 4 hours
Terminate and Descend	After 4-6 hours at float altitude, power will be shut off to the experiments. the balloon is released, a parachute is deployed, and the experiments descend.
Landing & Recovery	Experiments land, the location is tracked, and the Raven flight crew recovers the experiments to return to students.

VIDEO

PHOTO